DOCUMENT RESUME

ED 097 223 SE 018 270

AUTHOR	Lucido, Phillip J.
TITLE	The Development and Testing of Environmental and Societal-Related College General Biology Laboratory Experiences. Final Report.
INSTITUTION	Northwest Missouri State Univ., Maryville.
SPONS AGENCY	National Center for Educational Research and Development (DHEW/OE), Washington, D.C. Regional Research Program.
BUREAU NO	BR-2-G-012
PUB DATE	Aug 73
GRANT	OEG-7-72-0010(509)
NOTE	6?p.
EDRS PRICE	MF-$0.75 HC-$3.15 PLUS POSTAGE
DESCRIPTORS	*Biology; *College Science; *Curriculum Development; Educational Research; *Environmental Education; Evaluation; *Instruction; Interdisciplinary Approach; Laboratory Procedures; Science Activities; Science Courses; Science Education
IDENTIFIERS	Research Reports

ABSTRACT

The purpose of this project was to develop and test the effectiveness of relevant and functional general biology laboratory experiences based on the various media with which the student came in day-to-day contact. The review of the literature pertaining to the development of innovative general biology laboratory procedures for the college level showed a scarcity of new developments. Instruments used included the TOUS test to measure the understanding of the scientific enterprise and attitudes toward science, the Watson-Glaser Critical Thinking Appraisal, and an instructor-written test to test the students' achievement of written behavioral objectives. The report includes procedures used, results of testings, recommendations, and an extensive bibliography. of the "innovative labs" that were developed is found in the appendix. The author states that the study indicated that laboratory exercises can be developed that can, at least partially, provide meaningful experiences. (EB)

Final Report

Project No. 2G012
Grant No. OEG-7-72-0010 (509)

Dr. Phillip J. Lucido
Northwest Missouri State University
Maryville, Missouri 64468

THE DEVELOPMENT AND TESTING OF ENVIRONMENTAL AND SOCIETAL-RELATED COLLEGE GENERAL BIOLOGY LABORATORY EXPERIENCES.

August 1973

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

Office of Education

National Center for Educational Research and Development
(Regional Research Program)

ABSTRACT

The purpose of this project was to develop and test the effectiveness of relevant and functional general biology laboratory experiences. The laboratory exercises were based upon information available from various media in which the student comes in daily contact including newspapers, magazines, films, and video tapes. The major criterion used for laboratory topic selection was the following: Is the topic a significant social and/or environmental problem which can illustrate a basic biological concept.

The effectiveness of the laboratory treatments was measured by (1) The Test on Understanding Science, (2) The Watson-Glasier Critical Thinking Apprasial, and (3) final examination scores. A statistical comparison of group means was made using the student's *t* test. The results indicated that the "innovative labs" were as effective and functional as the "traditional labs" at least as measured by the Test on Understanding Science and the Watson-Glasier Critical Thinking Apprasial.

Final Report

Project No. 2G012
Grant No. OEG-7-72-0010 (509)

The Development and Testing of Environmental and Societal-Related College General Biology Laboratory Experiences

Dr. Phillip J. Lucido

Northwest Missouri State University

Maryville, Missouri 64468

August 1973

The research reported herein was performed pursuant to a grant with the Office of Education, U.S. Department of Health, Education, and Welfare. Contractors undertaking such projects under Government sponsorship are encouraged to express freely their professional judgment in the conduct of the project. Points of view or opinions stated do not, therefore, necessarily represent official Office of Education position or policy.

U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE

Office of Education
National Center for Educational Research and Development

PREFACE

Acknowledgement would like to be given to Sue Nothstine, Patricia Lucido and Dr. Jerry Gallentine for developmental assistance. Thanks is also given to Dr. Ronnie Moss who helped in the statistical analysis of the data.

TABLE OF CONTENTS

PREFACE iv
LIST OF TABLES vi
INTRODUCTION 1
Review of Related Literature 2
Problems and Objectives 2
PROCEDURES 4
Testing of the Newly Developed Laboratory Experiences 5
RESULTS 7
CONCLUSIONS 10
RECOMMENDATIONS 11
BIBLIOGRAPHY 12
APPENDIX A 14

LIST OF TABLES

Table 1. Test data from TOUS. D.F. = 89

Table 2. Test data from the Watson-Glasier Critical Thinking Apprasial (WGCTA). D.F. = 89

Table 3. Test data from the final examination scores. D.F. = 89

INTRODUCTION

Our nation is now awakening to the realization that we are facing a crisis in our environment as is evidenced by the flurry of publications in this area (1-14). With this awakening we find our present educational system inadequate to solve the problem of educating our young people to understand and cope with these problems on an intelligent basis. The technological advancements of our society have rapidly out-paced appropriate and needed advances on the educational front.

Although we are now generally aware of the major problems such as over population, water pollution, air pollution, noise pollution, nuclear radiation and others, the question remains how best to educate future citizens to understand and solve these problems. Numerous articles (15,16,17) stress the need for a citizenry who understand current progress in science, the need for basic and applied scientific research, and an appreciation of the relationship of science to society if such citizens are to make favorable and wise decisions concerning the continuing support of science and technology in the United States.

On the whole, American colleges and universities have made little meaningful progress in developing educational procedures which would cause the general education student to become a well informed citizen, who should not only have an understanding of his own body, his own reproductive processes, and his own inheritance, but should also have a sufficient biological and sociological background to understand the problem of population control, the genetic effect of radiation, the implications of pollution, and the basic concepts of behavior.

Obviously, no one course no matter how well designed and taught is going to accomplish all of the objectives listed above. However, there are several "general education" courses which are required of most college students that have the unique opportunity to make valuable contributions toward developing well informed citizens.

One such course taken as a general requirement in most colleges and universities is general biology(18). General biology is one of the most appropriate courses in which to introduce, discuss, develop and evaluate ideas, principles and concepts essential to understanding and coping with problems of our society. Most general biology courses offer, along with lecture-recitation, a laboratory experience.

It would seem then, that general biology and the general biology laboratory in particular would be a most appropriate and useful site for developing in the individual the understanding of basic technology, how it affects our lives and how to cope with it.

The laboratory setting allows the student to learn methods, approaches, skills, and abilities to deal with the problems facing him. Therefore if we truly intend to educate young

people in how to cope with these problems, it is proposed that the student must become involved personally, to interact and work with these problems because meaningful learning will not take place by mere exposure.

Review of Related Literature

In a review of the literature pertaining to the development of innovative general biology laboratory procedures for the college level there is a scarcity of new developments even though the middle school and secondary school curricula have undergone major changes in the last ten years. The dominant new curriculum in secondary school biology is the Biological Sciences Curriculum Study (BSCS) which emphasizes the "concept approach" and the use of the laboratory as the major teaching format. In addition, in the past few years educators have almost unanimously agreed that laboratory experiences are essential if general biology is to be a true science, since the laboratory is a basic and essential element of any science course (19, 20, 21, 22, 23, 24).

However, in reviewing a number of representative college biology laboratory manuals written for use in general biology courses, one finds the topics for investigation stereotyped around basically classical bio-traditional topics(25, 26, 27, 28, 29, 30, 31, 32, 33).

Other modern college biology laboratory manuals still hold to the taxonomic format of study (34,35,36,37). Others use the cell as their basic theme (38,39,40). Molecular biology is the theme for a few of the newer general biology laboratory manuals (41,42,43). Even though the whole laboratory approach has been changed in audio-tutorial lab,the subject matter included is still made up of traditional themes (44,45). All of the laboratory manuals reviewed, though varying slightly in approach, made little or no reference to their applicability or usefulness to the student in understanding environmental problems so perplexing in today's world.

Problems and Objectives

It was the purpose of this project to develop and test the effectiveness of relevant and functional general biology laboratory experiences. These laboratory procedures were to be based upon information available from various media in which the student comes in daily contact including newspapers, magazines, films and videotapes. Thus, the objectives of this study were twofold:

1. To attempt to develop functional general biology laboratory experiences based upon the various media with which the student comes in day-to-day contact.
2. To attempt to discover the relative affectiveness of these developed laboratory experiences upon the student's development of favorable attitudes toward science, critical thinking ability and an understanding of the scientific enterprise.

Effectiveness as is implied in the above objectives was shown by or defined in terms of

1. an understanding of the entirety of the scientific enterprise and attitudes toward science as measured by the TOUS test, and
2. the ability to think critically as measured by the Watson-Glasier Critical Thinking Apprasial, and
3. accomplishing the defined instructor written behavioral objectives of subject matter knowledge as measured by an instructor written test (final examination).

PROCEDURES

During the past few years, the general education course Bioscience has been structured around a two hour laboratory with three hours of lecture - recitation for a total of four semester hours of credit. For the most part, the laboratory topics which have been utilized in Bioscience up to this time followed the traditional pattern: Measurement, Chemistry of the Cell, The Cell, Mitosis, Transport Mechanisms, Homeostasis, Basic Genetics, Human Genetics, Ecology and similar topics.

For this project, a series of laboratory experiences to be used in a one semester course were researched, designed and written centering around social and/or environmental problems. The criteria for selection of the topics were as follows:

(a) is it a significant social and/or environmental problem which can illustrate a basic biological concept,

(b) can the topic be developed in such a manner as to make it understandable and meaningful for freshman level college students with a minimal science background and little, if any, skills or abilities in scientific manipulations,

(c) can the topic be designed in such a way as to make it adaptable for utilization by large numbers of students and require a minimum of specialized and expensive scientific equipment, and

(d) is the topic practical in terms of being effective with the use of materials and equipment readily available at reasonable cost.

The procedures for developing the selected laboratory topics were as follows:

1. Writing an introduction to the laboratory experience utilizing background information which clearly indicated to the student the relationship between the activities to be carried out and their relationships to everyday life. To help in this process, a newspaper was prepared entitled the B.S. Gazette (Biosocial Gazette). The newspaper consisted of various articles, found mainly in current popular magazines, which were relevant to the topic being discussesd. The articles were photographed and printed on newspaper for realism (this was done by the local newspaper at a relatively low cost). The students would spend the first few minutes of class reading the current issue of the newspaper which was handed out with the lab exercise.

2. Writing behavorial objectives which delineated the desired behavorial changes as a result of the student completing the laboratory experience.

3. Writing a progression of procedures for the students to follow in carrying out the laboratory activities. If possible procedures were designed so as not to be so structured so as to stifle individual ingenuity and inquiry. Frequently, the "why" and "how to's" were left up to the student's themselves.

4. An evaluation where possible, was designed to test whether the students could apply what they learned from the laboratory experience.

Titles for the laboratory expériences developed were the following: Metric System, Candy Coated Children's Hour, Don't Eat that Dog, Cell-A-Thon, Mitosis, Genetics, Reproduction, Development, Population, Drugs, and Pollution. A brief description of each lab and four laboratory units which were designed are in Appendix A.

Testing of the Newly Developed Laboratory Experiences

The newly designed laboratory experiences were used during the first and second semesters of the 1972-1973 school year. The selection of students for the Bioscience labs used for this project was accomplished through normal enrollment procedures. Four Bioscience lab sections were used during each semester. The four laboratory sections were divided into two groups (two lab sections/group). One group was assigned the "traditional labs" while the other group was assigned the "innovative labs."

Those laboratory sections assigned the "traditional labs" utilized laboratory experiences developed in the past and which are presently used by the Bioscience Staff at Northwest Missouri State University. Here, the laboratory period is introduced by the instructor with a pre-laboratory discussion of the laboratory objectives, procedures, and use of equipment. Then, the students perform the laboratory experience for the day.

The laboratory sections assigned the "innovative labs" utilized the newly developed laboratory experiences. These laboratory experiences centered around social and/or environmental problems which could illustrate a basic biological concept. These laboratory periods were taught in the same manner as the "traditional labs."

All students, irrespective of the laboratory treatment, received at the beginning of the course the behavioral objectives for the course. All students involved were administered a pre-test battery composed of the Test on Understanding Science, Form W (TOUS) and the Watson-Glasier Critical Thinking Appraisal, Form Zm. All students were administered the same final examination as a measure of attaining the

behavioral objectives of the course. The Test on Understanding Science and the *Watson-Glasier Critical Thinking Apprasial* was administered to all students as a post-test to measure their understanding of the scientific enterprise, their attitude toward science and their ability to think critically.

In order to determine the relative effectiveness of the laboratory treatment a Student's *t* test was made on the group means from the scores attained in the above tests. The hypotheses of this research stated in the null form are:

1. There is no significant difference in the understanding of science as measured by TOUS between those students in the "traditional labs" and those students in the "innovative labs."
2. There is no significant difference in the ability to think critically as measured by the *Watson-Glasier Critical Thinking Apprasial* between those students in the "traditional lab" and those students in the "innovative labs."
3. There is no significant difference in the attainment of the specified cognitive skills as measured by the instructor written test (final examination) between those students in the "traditional labs" and those students in the "innovative labs."

The null hypotheses would be rejected if the value of the *t* test exceeded the tabular value at the .05 level of confidence. The statistical results were obtained by using the appropriate *t* test formulas for either significant or non-significant variances. The data was run by computer program on the Hewlett-Packard 2115A. The program allows five decimal places for any rounding off procedures.

A questionaire was also given to the students in order to determine their opinions of the "innovative" and "traditional" laboratories. Questions were asked about relevance, creativity, and laboratory format.

RESULTS

Statistical analysis of the data gathered from the first and second semesters of the 1972-1973 school years was as follows:

1. Null hypothesis: There is no significant difference in the understanding of science as measured by TOUS between those students in the "traditional labs" and those students in the "innovative labs."

Table 1. Test data from TOUS D.F. = 89

Measurement Indicator		Group Means Traditional	Innovative	t value	significance
1st semester TOUS	Pre-test:	33.98	33.47	-0.356	P>.05
	Post-test:	32.07	33.12	0.654	P>.05
2nd semester TOUS	Pre-test:	30.79	31.85	0.736	P>.05
	Post-test:	30.93	32.35	0.922	P>.05

The _t_ value was not significant at the .05 level. Thus, it indicates a failure to reject the null hypothesis concerning the TOUS measurement indicator.

2. Null hypothesis: There is no significant difference in the ability to think critically as measured by the _Watson-Glasier Critical Thinking Apprasial_ between those students in the "traditional labs" and those students in the "innovative labs."

Table 2. Test data from the _Watson-Glasier Critical Thinking Apprasial_ (WGCTA). D.F. = 89

Measurement Indicator		Group Means Traditional	Innovative	t value	significance
1st semester WGCTA	Pre-test:	62.14	61.29	-0.399	P>.05
	Post-test:	65.67	61.73	-1.853	P>.05
2nd semester WGCTA	Pre-test:	60.44	60.67	0.100	P>.05
	Post-test:	59.23	63.79	1.947	P>.05

The _t_ value was not significant at the .05 level. Thus, it indicates a failure to reject the null hypothesis concerning the _Watson-Glasier Critical Thinking Apprasial_.

3. Null hypothesis: There is no significant difference in the attainment of the specified cognitive skills as measured by the instructor written tests (final examination) between those students in the "traditional labs" and those students in the "innovative labs."

Table 3. Test data from the final examination scores D.F. = 89

Measurement Indicator	Group Means Traditional	Innovative	t value	significance
1st semester Final Exam	60.26	56.18	-1.605	P>.05
2nd semester Final Exam	56.05	62.63	2.163	P>.05

The t value was not significant at the .05 level for data from the first semester. Thus, it indicates a failure to reject the null hypothesis. However, the t value was significant at the .05 level for the data from the second semester. Thus, the rejection of the null hypothesis is indicated. There is no readily apparent definitive reason for the complete turn around of these results. Before any definite statement could be made on the effectiveness of the two types of laboratories with regard to this hypothesis, further studies would be needed. In regard to the other two hypotheses tested, the results did indicate that the "innovative labs" were as functional and as effective as the "traditional labs" in enabling the students to understand science and think critically.

In comparing student activities in the two types of laboratories, the students in the "traditional labs" generally asked questions about techniques, location of materials, diagrams, etc. They seemed concerned about clarifying the material, but did not often try to apply the material to themselves. In contrast, the students in the "innovative labs" asked questions and carried on discussions that related to their personal interests or experiences. The discussions were very free and the direction of the discussion often differed from class to class.

In order to verify these observations, a questionaire was distributed at the end of each semester to the students in both the "traditional" and "innovative" labs. When asked if their lab gave them a chance to think creatively, 39% of the "traditional lab" students responded favorably, compared to 66% in the "innovative labs." With regard to the relevance of the lab material, 53% of the students in the "traditional labs" felt most of the topics were relevant, while 14% felt all topics were relevant. In the "innovative labs," 58% thought most of the topics were relevant, while 39% thought all topics were relevant.

The students were asked if they felt discussion was an important part of the learning process. In the "traditional labs," 74% felt it was important, and 82% of the students in the "innovative labs" thought discussion was important. When asked if they would like more discussion in lab, 40% of the students in the "traditional labs" indicated they would like more discussion, while 25% of those in the "innovative labs" felt more discussion was necessary.

When asked if they became more interested in biology because of the laboratory, 24% of the students in the "traditional labs" felt they were more interested. In the "innovative labs," 32% of the students expressed more interest in biology because of the lab. Personal comments from students in the "innovative labs" indicated they enjoyed the labs because of the freedom and varying format.

The instructors felt that they had to be well read and up to date in order to be prepared for the varied discussions that took place in the "innovative labs." This made the labs more interesting and challenging to the instructors. As a result the "innovative labs" were less dull and mechanized than the "traditional labs."

CONCLUSIONS

Today, lay persons and science teachers alike are more aware of the need for more relevant lab material. This study indicated that laboratory exercises can be developed that can, at least partially, provide meaningful laboratory experiences. Laboratory experiences based on societal and/or environmental problems were as functional and as effective as the "tradition al" laboratory experiences taught in the Bioscience course. Statistical analysis of group means from student scores on TOUS and the Watson-Glasier Critical Thinking Apprasial showed there was no significant difference between the students in the two types of laboratories. In addition, a greater percentage of the students in the "innovative labs" thought that they were given more opportunity to think creatively, that the laboratory topics were more relevant to their everyday life, and that their interest in biology increased.

RECOMMENDATIONS.

The "innovative labs" are recommended for use in general biology laboratories, especially for non-biology majors. The "innovative labs" did give the students some insight as to the social relevance of biology. However, the "innovative labs" may not provide the students with certain techniques that some teachers may want their students to learn from general biology for use in their more advanced courses. Generally speaking, though, it is thought from this study that this type of "innovative" laboratory approach would help students relate to the complex environment in which they live, and to the technological advances in science which will affect their futures economically, culturally, ethically, and politically.

BIBLIOGRAPHY

1. Bernarde, Melvin A., Our Precarious Habitat, W.W. Norton and Co., Inc., New York, 1970
2. Bresler, Jack B., Environments of Man, Addition-Wesley Publishing Co., Reading, Mass., 1968
3. Carson, Rachel. Silent Spring, Houghton-Miffin Co., Boston, 1962.
4. Commoner, Barry. Science and Survival, Vicking Press, New York, 1967
5. Cook, Robert C. and Jane Lecht. People! Columbia Books, Washington, D.C., 1968
6. Cox, George W., Readings in Conservation Ecology, Meredith Corporation, New York, 1969
7. Dasmann, Raymond F. Environmental Conservation, John Wiley and Sons, Inc., New York, 1968
8. Ehrenfeld, David W., Biological Conservation, Holt, Rinehart and Winston, Inc., New York, 1970
9. Ehrlich, Paul R., The Population Bomb, Ballantine Books, Inc., New York, 1968
10. Ehrlich, Paul R. and Anne H. Ehrlich, Population Resources Environment, W.H. Freeman and Company, San Francisco, 1970
11. Helfrich, Harold W., The Environmental Mental Crisis, Yale University Press, New Haven, 1970
12. Johnson, Cecil E. Social and Natural Biology, D.Van Nostrand Co., Inc. Princeton, 1968
13. Rudd, Robert L., Pesticides and the Living Landscape, University of Wisconsin Press, Madison, 1964
14. Weisz, Paul B., The Contemporary Scene, McGraw-Hill Book Co., New York, 1970
15. Pella, O'Hearn, and Gale. "Preferents to Scientific Literacy," J. Res. Sci. Teaching, 4, 199-208, 1966.
16. Earl Ubel. "Science in the Press: Newspapers and Magazines," Journalism Quarterly, 40, 293-299, 1963
17. Wood, Pella, and O'Hearn. "Scientifically and/or Technologically Oriented Articles in Selected Newspapers," J. Res. Sci. Teaching, 5, 151-153, 1967-1968
18. Directory of Bioscience Departments in the United States and Canada, American Institute of Biological Sciences, Reinhold Publishing Corporation, New York, 1967.
19. Biology for the Non-Major, Commission on Undergraduate Education in the Biological Sciences, Washington, D.C. 1967
20. Brandwein, Watson, and Blackwood. A Book of Methods, Harcourt, Brace, and World, Inc. New York, 1958
21. Harding, Volker, and Eagle. Creative Biology Teaching, The Iowa Press, Ames,Iowa, 1969
22. Sund and Trowbridge, Teaching Science by Inquiry, Charles E. Merrill Books, Inc. Columbus, Ohio, 1967
23. Thurber and Collette. Teaching Science in Today's Secondary Schools, Allyn and Bacon, Inc. Boston, 1959
24. Woodburn and Osbourn. Teaching the Pursuit of Science, The Macmillan Company, New York, 1965

25. Abramoff and Thomson. Laboratory Outlines in Biology. W.H. Freeman and Company. 1963
26. Beaver and Noland. Workbook and Laboratory Manual in General Biology. The C.V. Mosby Company. 1966
27. Buffaloe and Collins. Laboratory Manual for Principles of Biology. Prentice-Hall, Inc. 1963
28. Davis, Dawson, Cockrum. Laboratory Exercises in Biology. W. B. Saunders Company, 1966
29. Keeton, Dabney, Zollinhofer, Laboratory Guide for Biological Science. W.W.Norton and Company, Inc. 1968
30. Morholt. Experiences in Biology, Harcourt, Brace and World, Inc. 1967
31. Mertens and Malayer. Laboratory Exercises in the Principles of Biology. Burgess Publishing Company, 1966
32. Nelson and Latina. Laboratory Manual: Experiments in Fundamental Concepts of Biology, John Wiley and Sons, Inc. 1968
33. Winchester, Biology Laboratory Manual, Wm.C. Brown Company, 196
34. Cooper and Cillon. A Laboratory Survey of Biology. The Macmillan Company, 1969
35. Korn. Investigations into Biology, John Wiley and Sons, Inc. 1965
36. Lee and Breland. Biology in the Laboratory, Harper and Row, 1965
37. Mavor and Manner. Laboratory Exercises in General Biology, The Macmillan Company, 1967
38. Abramoff and Thomson. Investigations of Cells and Organisms, Prentice-Hall, Inc. 1968
39. Baker, Allen, Gage, and Webster, Experiments in the Study of Biology. Addison-Wesley Publishing Company. 1967
40. Bowen. Experimental Cell Biology, The Macmillan Company, 1969
41. Humphrey, Van Dyke, and Willis, Life in the Laboratory, Harcourt, Brace, and World, Inc. 1969
42. Kaplan. Problem Solving in Biology, The Macmillan Company, 1968
43. Weisz. Laboratory Manual in the Science of Biology, McGraw-Hill Book Company, 1964.
44. Barnum, Gillespie, Greer, Peardon. Audio-Tutorial Introductory Biology: Principles, Glencoe Press. 1969
45. Postlethwait, Novak, Murray. An Integrated Experience Approach to Learning, Burgess Publishing Company, 1964

APPENDIX A

A brief description of the "innovative labs" that were developed is as follows:

Metric A Go-Go presented everyday metric measurements to the students. The students constructed their own conversion tables by using meter sticks, yard sticks, thermometers, empty juice cans, beaker, packages of food, and balances. They completed an activity that emphasized the need for uniform units of measurement and they compared the time it took to make conversions using the English system as opposed to the metric system.

The Candy-Coated Childrens Hour was the first of a two part investigation. The class was set up as the National Nutritional Association. Groups of students were divided into different departments - fats, carbohydrates, protein, etc. First they defined assay techniques, and then each department assayed test materials that confirmed the department's technique.

Don't Eat That Dog emphasized personal nutrition. All departments assayed the numerous food products that were available. Then, they completed a Consumer Products Data Sheet. This information gave the students a qualitative evaluation of the food products. In addition, the students each completed a self-evaluation chart on their food intake for one day, and then, using nutritional catalogs, filled out the amount of protein, fat, and carbohydrates, and calories they ingested.

The Cell-A-Thon lab consisted of a series of stations dealing with the use of the microscope, typical plant and animal cells, and cell functions. Students could proceed through the material at their own rate.

The Mitosis lab was a completely independent exercise. A packet of information identified the major cell parts involved in cell division. There were diagrams of the major phases of mitosis that described the important changes in the cell during division. In addition, mitosis was compared to meiosis with respect to location, process, and end results.

The Genetic Engineering lab was also an individualized packet. The material dealt with genetic monohybrid and dihybrid crosses, examination of human hereditary characteristics, and fruit fly crosses.

The Reproduction unit dealt with basic human anatomy, behavioral traits, and physiology. Filmloops supplemented this material. The four main venereal diseases were also studied. Much of this lab was discussion orientated.

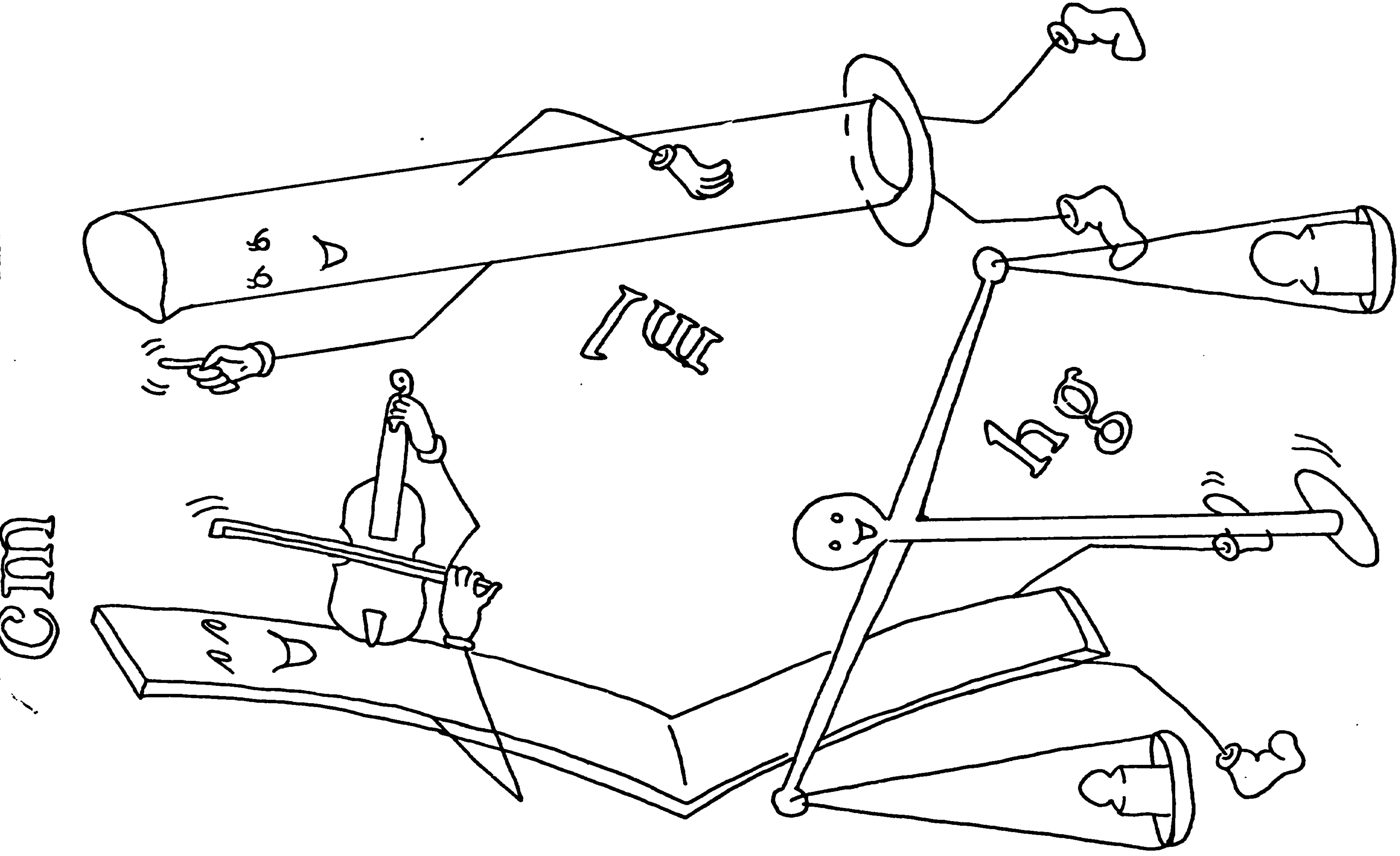
The Development lab was concerned with human development through birth, and the stages of delivery. Filmloops and a film were used to supplement the lab material. A great part of the lab was discussion.

The Population lab investigated some current theories about population trends in the future. The students practiced graphing and interpreting data on population projections.

The Drug lab was concerned with the physiological effects of stimulants, relaxants, hallucinogins, depressants, and narcotics. Several case histories were examined and the type of drugs involved were determined by the use of drug testing kits.

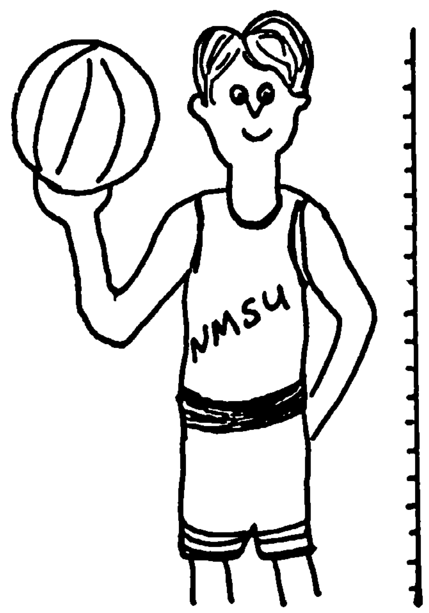
The Pollution lab was an open discussion type of laboratory exercise that centered around an imaginary company planning to build in the local community. The students split into groups representing various factions of the town. A "town meeting" was held to determine whether or not the company would be encouraged to build. Tape recordings of local business leaders, the city manager, the city engineer, etc. were made available to the students to help them in their roles.

METRIC A-GO-GO



METRIC A GO-GO

As can be surmised from the foregoing excerpts, the adoption of the metric system of measure by the U.S. is not only inevitable, but is imminent. Everyone needs to have a basic understanding of this system, not only because it is utilized extensively in science today, but because it will be a part of daily life tomorrow. The following activities are designed to test your awareness of measurement in general and to facilitate your future use of the metric system in particular. How well do you "measure up?"



Objectives:

After the student has completed the following activities, he should be able to demonstrate in writing his achievement of the following objectives.

1. Explain the need for uniform units of measurement.
2. Tell why the metric system is easier to use than the English system, and illustrate this point with examples.
3. Design a chart of the most common English units and their magnitude in the Metric system.
4. Demonstrate in writing the ability to work with and convert common English units of measure to the Metric system.

I. STRIP-TEASE

You will find two strips of paper, two cups, and a large tin can on your lab table. Each student will take one of the strips of paper and measure the height of the lab table. He will also take one of the cups and determine how many cupfuls of water the large can holds. All data should be recorded below:

<u>DATA</u>

Student 1 - table height = ______________ paper lengths

Student 2 - table height = ______________ paper lengths

Student 1 - volume of can = ______________ cupfuls

Student 2 - volume of can = ______________ cupfuls

Now think!

What have you learned from this activity?

How do you relate what you have learned from this activity to the life situation in general?

II. CONVERSION AVERSION?

Do you suffer from this? If so, prepare to be cured of your ailment--for such aversions arise mainly from a basic lack of understanding. Once a new system is clearly understood, conversion to it is simple. The following should help you to better understand both the Metric and English systems of measure and how they work.

English System - Common Units

Length	- inch (in), foot (ft), yard (yd), mile
Mass	- ounce (oz), pound (lb), ton (T)
Volume	- cup (cp), pint (pt), quart (qt), gallon (gal)
Temperature	- °Fahrenheit

Look at the units of measure above. Think about how they are related as you examine the conversion table below.

English System - Conversion Table

Length:	______	inches = 1 foot
	______	feet = 1 yard
	______	yards = 1 mile
Mass:	______	ounces = 1 pound
	______	pounds = 1 ton (short)
Volume:	______	cups = 1 pint
	______	pints = 1 quart
	______	quarts = 1 gallon

Can you see any special relationship between the different units of length?____________ How about Mass?____________ or volume?______________

Is there any overall relationship between length units, mass units and volume units?

Now let's look at the common units in the metric system and a similar conversion table.

Metric System - Common Units

Length	- millimeter (mm), centimeter (cm), meter (m), kilometer (k,)
Mass	- milligram (mg), gram (g), kilogram (kg)
Volume	- milliliters (ml), liter (l), kiloliter (kl) 1 ml also equals 1 cubic centimeter (cc)
Temperature	- °Centigrade

Now study the metric system conversion table below which has already been filled out for you

Metric System - Conversion Table

Length:	10	millimeters = 1 centimeter
	100	centimeters = 1 meter
	1000	meters = 1 kilometer
Mass:	1000	milligrams = 1 gram
	1000	grams = 1 kilogram
Volume:	1000	milliliters (or cc's) = 1 liter
	1000	liters = 1 kiloliter

Do the different levels of measurement within each of the three groups seem to be systematically related? If so, how?

How does this relationship compare to the English system?

What have you learned from this activity?

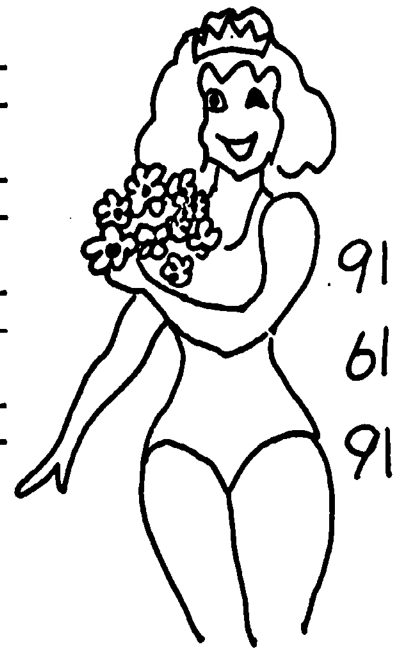
How do you relate what you have learned from this activity to the life situation in general?

III. METRICATION FASCINATION?

Due to your outstanding intelligence and overwhelming enthusiasm for science, you have been chosen to make up a simple conversion table to facilitate the entrance of the metric system into everyday American life. This table should outline common English measures and their equivalents in Metric measure. Using only the equipment available and any original techniques you wish to employ, make up a conversion table. Try to include at least two conversions for all four types of measurement (length, mass, volume, and temperature).

Conversion Table - English to Metric

Length	______	=	______
	______	=	______
Mass	______	=	______
	______	=	______
Volume	______	=	______
	______	=	______
Temperature	______	=	______
	______	=	______



What have you learned from this activity?

How do you relate what you have learned from this activity to the life situation in general?

IV. WEIGHTY MATTERS

Each student will weigh three different (ml) volumes of liquid in grams. One student will use water; the other, molasses. Record data:

H_2O	______	ml =	______	g
	______	ml =	______	g
	______	ml =	______	g
Molasses	______	ml =	______	g
	______	ml =	______	g
	______	ml =	______	g

What have you learned from this activity?

How do you relate what you have learned to the life situation in general?

V. THE 100 METER DASH

The big race is about to begin. Poised on the starting line and eager to compete is "Big M", a wellbuilt young racer, fairly new to this U.S. racetrack but well known throughout the world. There beside him, equally eager and somewhat smug and confident is "Big E". Although more gangly than "M", he has always been the winner here in the U.S. As the starting gun fires both racers take off for the finish line--solving, as accurately as possible all conversion problems in their pathways. He who arrives at the finish line first with the least amount of errors is the winner. The racers are allowed to refer to conversion tables available within this lab exercise.

Get ready. . . . . .Get set. . . . .

3. Which is larger, 4 liters or 5000 milliliters?

3. Which is larger, 4 gallons or 54 cups?

2. 4000 grams equals how many kilograms?

2. 4000 pounds equals how many tons?

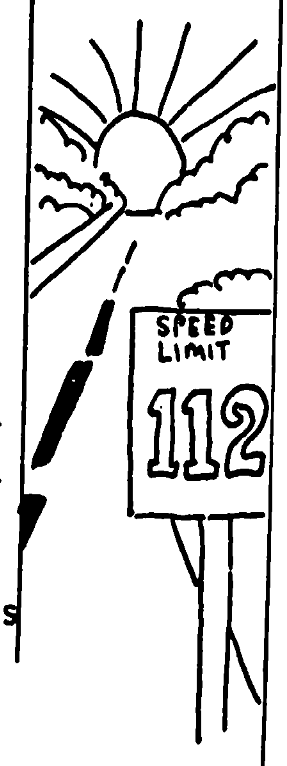
GO

4. What are the freezing points and boiling points of water?

4. What are the freezing points and boiling points of water?

1. Convert one kilometer to millimeters

1. Convert one mile to inches.



5. One cup of water weighs ______ lbs.

5. 10 milliliters of water weighs ______ g.

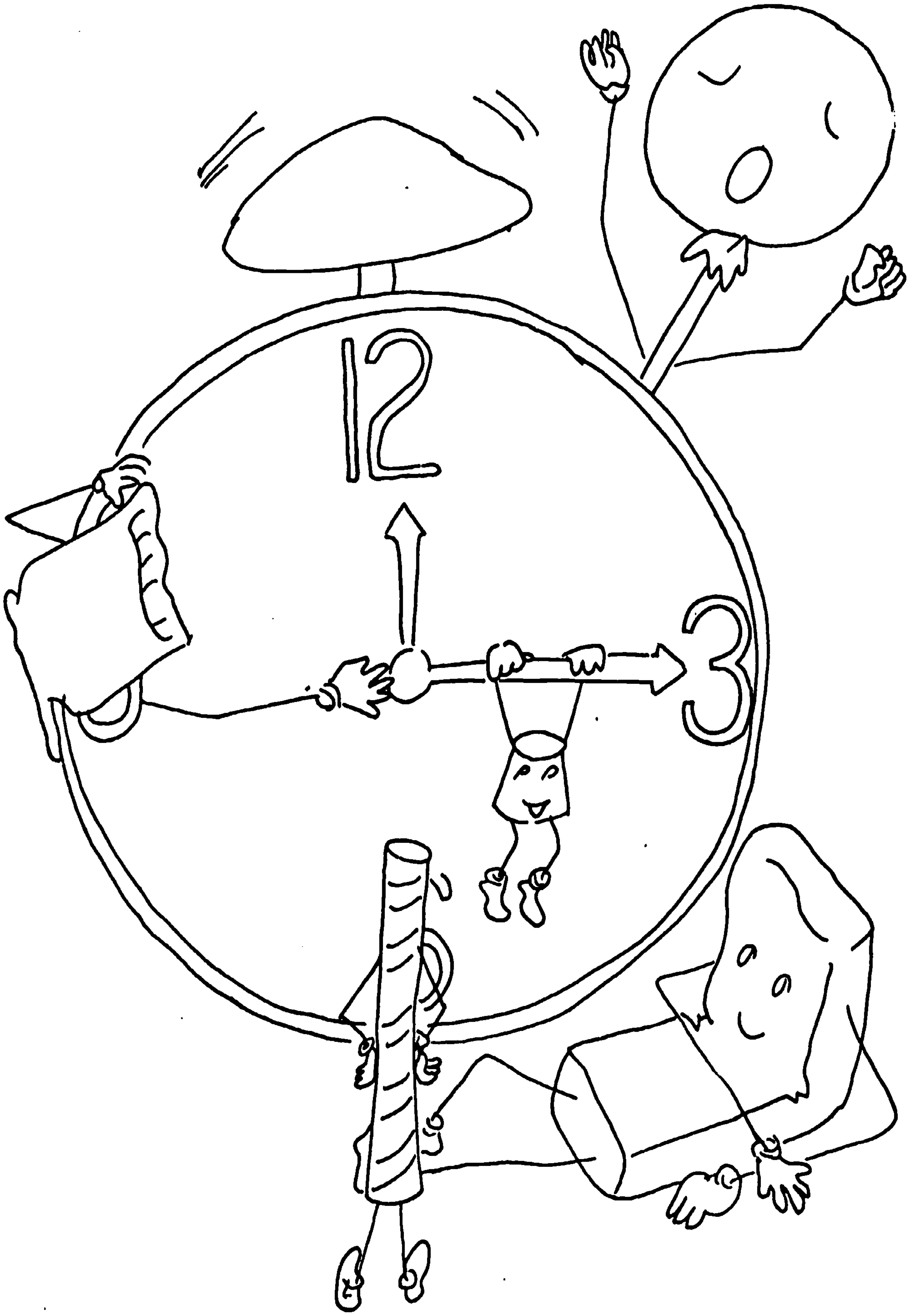
"Big M" START "Big E"

Role played by student #1 using metric units

Role played by student #2 using English units

FINISH

CANDY COATED CHILDREN'S HOUR



WHAT ARE LITTLE BOYS MADE OF?

Snakes and snails and puppy dog tails? . . . . Hopefully not, although we must admit that snakes, snails, puppies and boys are all made essentially of the same things. This is because they are all living things whose composition includes certain important organic compounds which contribute heavily to live characteristics. Being egocentric, as we all are, we would like to believe that we living things are made of all sorts of fascinsting and complicated ingredients . . . . sugar and spice and everything nice! Not wishing to dampen your spirits--did you know that you are approximately 85% water? That's right. Protoplasm, the living substance which makes up our cells, is about 85% water, 10-20% protein, 13% fat (lipid), and a small percentage of both sugar (carbohydrate) and nucleic acids.

Now we all probably know that both eggs and "breakfast squares" contain protein, and so do some hairsprays. We know that fat is something which collects under our skin in all the wrong places when we make too many stops at the Dairy Queen (or at the Pub, for that matter). We know that sugar is what we put in our morning coffee, and what we take out of diet cola. And although we may never have heard of nucleic acids, we all probably recognize DNA as being something important. Seriously though, how much do you really know about the stuff you are made of? Here you have been in existence for some 20 years, more or less, and you've probably never really bothered to learn about the vehicle you've been riding around in all this time, your body. At some time or another we have all probably gone out of our way to avoid buying cheap gasoline for our cars. We know cheap gas is not good for the engine and we are acutely aware of the resulting gas "ping". How many of us are as careful about what we put into our bodies? Our bodies utilize the food we give them in order to maintain themselves, grow and reproduce. The food we eat provides energy so our bodies can function. A poor energy supply invariably results in poor function. We are what we eat. It is hoped that the following activity will not only help you to better understand your body, what it is made of, and it's nutritional needs, but also give you some insight into nutritional problems which are encountered by all of us in this day and age of "freeze-dried" this and "reconstituted" that!

Objectives:

After the student has completed the following activities, he should be able to demonstrate in writing his achievement of the following objectives:

1. Define the term "assay" and describe the characteristics of a good assay procedure (control, quantification,precision, discriminating factors).

2. List and describe the major nutritive materials making up protoplasm.

3. Describe how to determine whether a "test material" contains monosaccharides, disaccharides, polysaccharides, fats, protein, and vitamin C.

4. Analyze data and devise an acceptable assay technique for the information provided.

ACCEPTED

BEST COPY AVAILABLE

National Nutrition Association

Job Application Form

Name B. S. Student Phone unlisted

Address Number Two, St. Joe Birth Date ?

Application Date September 15, 1972

Kind of position applied for Lab technician

Previous Employment Record:

Dates of Employment	Title of Position	Description	Salary	Employer	Reason for terminating employment
3/68 - 3/69	Dish washer	Tired	$.50/hr	My Mother	Grew up!
3/69 - 3/70	Playboy Advisor	Happy	None	Playboy Magazine	God only knows!
9/71	Student	Poor	None	NWMSU	Still working at it.

Lowest salary acceptable for this job Passing grade in B.S.

ACCEPTED

National Nutrition Association
Scientific Assay Laboratories

Memorandum

From: Chairman of the Board--NNA Assay Laboratories

To: All new employees

Welcome to our organization. We would like to supply you with some general information concerning the National Nutrition Association.

Americans have given some of the responsibility for food protection to our agency. Our organization has 20 district offices across the United States and employs over 7,000 people. Some are inspectors who routinely examine food plants, monitor food shipments, and check for misleading label claims on foods sold in retail stores. Other employees are scientists who conduct laboratory experiments, study scientific work outside the agency, and serve as technical advisers to the public health agencies of other nations.

Our particular division of this organization is concerned with the chemical assay of various consumer products. We attempt to evaluate the chemical make-up of representative products, to predict their effect on the consumer, and to make marketing recommendations accordingly. Our operation is divided primarily into five departments. Each department is concerned with a particular aspect of body make-up and body needs. The departmental structure and jobs available within each department are listed on the following pages. After carefully reading this information and sufficiently familiarizing yourself with our organization, fill out the job request form provided and turn it in to the Personnel Director.

JOB DESCRIPTION INFORMATION

NNA Assay Laboratories

Department	Necessary Background Briefing	Job Title	Duties	Opening
C A R B O H Y D R A T E D E P T	The Carbohydrate department is divided into three divisions: Monosaccharides are the most basic units of all carbohydrate molecules-Frequently referred to as a simple sugar-the momosaccharide unit consists of one ring of carbon atoms charactistically including two hydrogen atoms and one oxygen atom for each carbon in the ring. <u>Examples</u> Glucose - a ring of six carbon atoms--used as ready fuel for cell acitvity	Department Head	Report at general board meeting on findings of dept. Organize labor between division Help wherever needed	One Opening
	Disaccharide division--Disaccharides consist of two monosaccharide rings together-also referred to as sugar. <u>Examples</u> Sucrose common table sugar, Lactose sugar found in milk Maltose--sugar found in malt All of these sugars are also used for ready fuel, however, they first break down into monosaccharide units before utilization.	Division Directors _MonoSac _DiSac _PolySac	Runs respective divisions Organizes labor-- Helps plan, do and evaluate lab work	One Opening Each- monosa and po sac di sions.
	Polysaccharide division--Polysaccharides are chains of 3 or more saccharide units. Examples: Starch-utilized for fuel storage in plants--also for making collars stiff Glycogen Principle fuel storage form in animals Cellulose plays major supportive role in plant structures--mainly cell wall make-up	Lab Employees	Help plan, do, and evaluate lab work concerning daily work assignments	MonoSac Divisio _4 open DiSac Divisio -positi filled-workers at DiSa Convent in St. Louis PolySac Divisio -3 openings

Department	Necessary Background Briefing	Title	Job Duties	Openings Available
FAT DEPT	The Fat department works as one unit-Fats structurally consist of a glycerol molecule with three fatty acid molecules attached to it - Fats differ one from another because they have different fatty acids in varying order attached to the basic glycerol molecule-Fats constitute a reserve fuel supply in the cell - To utilize the fuel supply, fats, like polysaccharides, must be broken down to smaller units. They also are part of many cell structures including cell membranes and mitochondria. And, of course, fat has long been recognized as the principle body insulator. Examples: Animal Fat--butter, lard Plant Fat--corn oil, olive oil, and margarine	Dept. Head	Report to board of directors and chairman at general board meetings on departmental findings--Organize labor--Help, do, and evaluate lab work	One Opening
		Lab Employee	Help plan, do, and evaluate lab work concerning daily work assignments	Four Openings
PROTEIN DEPT	Proteins are far more complex than either carbohydrates of fats. The basic building blocks of the proteins are the amino acids-Some 23 amino acids combine in long chains to make up proteins--These chains in turn twist and fold to make a very complex structure--Proteins are important functionally as enzymes-Enzymes regulate the chemical reactions in the cell-Structurally, proteins can be found in almost all parts of the cell Examples: Gelatin and hair	Dept. Head	Report to Board of Directors and chairman at general board meetings on departmental findings--Organizes labor-Helps do and evaluate lab work	One Opening
		Lab Employee	Help plan, do and evaluate lab work concerning daily work assignments	Four Openings

Department	Necessary Background Briefing	Title	Job Duties	Openings Available
NUCLEIC ACID DEPT	The nucleic acid department deals with DNA and RNA-On these molecules is coded the genetic information that controls and directs all of the activities of protoplasm--The nucleic acid structure is one of a spiral ladder or double helix.	Dept. Head	Report at general board meetings on findings of department-Organize labor between divisions--Help wherever needed	Lab closed due to power failure in this wing of plant
		Lab Employee	Help plan, do, and evaluate lab work concerning daily work assignments	Lab closed due to power failure in this wing of plant
VITAMIN DEPT	The vitamin department is concerned with vitamins. These are relatively simple organic compounds that are present in the body in very samll amounts and are essential to life. Vitamins are synthesized mainly by plants so animals must therefore take most of them into their body from outside sources. They play an important enzymatic role in cell metabolism--(This department specializes in Vitamin C).	Dept. Head	Report at general boart meetings on findings of department-Organize labor between divisions--Help wherever needed	One Opening
		Lab Employee	Help plan, do, and evaluate lab work concerning daily work assignments	Four Openings

ASSAY TECHNIQUE

An assay is defined as an analysis of something to determine the presence, absence, or quantity of a particular component in that something.

Example: You are given a case of bottled beer by the proprietor of the local pub. The cases had gotten wet and all the labels had consequently fallen off the bottles. Being naturally inquisitive, you wonder if it is "near beer" (0% alcohol), 3.2 beer (3.2% alcohol), 5.0 beer (5% alcohol), or one of those splendid German brands (7-10% alcohol). Being scientifically oriented, you might decide to assay the beer for its alcoholic content.

Development of a good assay involves the use of some particularly unique aspect of the component you are assaying for. This unique aspect must always be viewed with respect to a control. A control substance is one which we know does not contain what we are assaying for, but otherwise resembles the test substance. The control undergoes all the experimental tests right along with the substance being assayed. By looking at results obtained with the control, we can easily see what non-reaction looks like and also have some proof that the test result we are looking for is due to the substance we are assaying for, and not some other component.

Example: We all know that alcohol has the fairly unique property of making one tipsy if enough is consumed. Therefore, a rather crude assay technique might be to consume a large quantity of the beer and observe the results. Remember, we would also have to consume an equal amount of a control substance; for example, water. Then we would know what non-tipsy behavior looks like and are somewhat assured that the tipsiness is a result of the presence of the alcohol. With this method we could easily distinguish between "near beer" and the others. But how can we tell the difference between 3.2 beer and 7.0 beer?

Assay techniques often involve quantification. Results are sought in terms of actual quantity of the substance assayed for. Frequently, the "experimental" substance is compared to several "known" substances, and it's quantity estimated accordingly.

Example: You might go out and buy some 3.2 beer, some 5.0 beer, and some German beer. Then:

1. Determine how much of each one of these three types of beers you can drink and still be able to walk a straight line.
2. Determine how much of the "experimental" beer you can drink and still walk a straight line. (Record data if physically possible)
3. Drink a comparable amount of H_2O to test the effect of fluid intake on your ability to walk a straight line. See non-reaction and record.
4. Possible Data

Beer	Straight-line limit
3.2 beer	12 bottles
5.0 beer	9 bottles
German beer	6 bottles
Experimental beer	8 bottles
Water	20 bottles produced no effect--walked straight line to nearest commode.

5. Analyze your data and see which known beer the results of the experimental beer most closely approximates. The experimental beer is probably the 5.0 variety.

Needless to say, an experiment such as this would best be performed over a period of several days--due to the recovery time needed following each period of consumption.

The experimental design in the foregoing example is useful for illustrating some important aspects of an assay:

1. Use of a unique property of the substance tested to distinguish it from other components.
2. Use of a control to see non-reaction and prove unique property does in fact belong to substance tested for.
3. Quantification--possibly by comparison of the experimental substance to several "known" substances.

However, if this experiment were actually performed, one would probably discover that you could not quantitatively tell the difference between 3.2 beer and those of higher alcoholic content. In other words, 10 bottles of all of them yielded impaired straigh line walking abilities. This would mean that the assay techniques employed were not precise enough--not sufficiently discriminating. At this point one might think to attempt a chemical analysis of th experimental beer. However, by this time the case is probably empty anyway!

NNA ASSAY DATA SHEET

Assay for: ______________________________

Unique property of above compound utilized:

Basic method employed:

Quantification technique:

Control utilized:

Proof this assay is specific for said compound:

How precise is your assay:

NNA Labs--General Board Meeting Notes

Work Assignment

Carbohydrate Department

ATTENTION: Monosac and Polysac Divisions

Due to the fact that our Disac personnel is otherwise occupied at a convention in St. Louis, it will be your job to pool your talents and come up with an assay for Disaccharides. Someone should be prepared to explain your assay methods for disaccharide sugars at the board meeting. Assay data sheets should be reviewed with the Chairman of the Board before said board meeting.

Work Assignment

Carbohydrate Department

Monosac Division

Given Facts:

1. Monosaccharides, when heated for one to two minutes in the presence of Benedict's Solution react to form an orange precipitate.

2. Disaccharides break down into monosaccharides when heated for 3 to 10 minutes.

Using the materials available in your lab area, design one or more assays for monosaccharides. Your department head should be prepared to explain your assay methods at the general board meeting immediately following this work period. Assay data sheets should be reviewed with the Chairman of the Board before said board meeting presentation.

Work Assignment

Carbohydrate Department

Polysac Division

Given Fact:

1. Polysaccharides react with iodine solution to form a dark black color.

Using the materials available in your lab area design one or more assays for polysaccharides. Your department head should be prepared to explain your assay methods at the general board meeting immediately following this work period. Assay data sheets should be reviewed with the Chairman of the Board before said board meeting presentation.

Work Assignment

Fat Department

Given Facts:

1. Fat produces a grease mark on paper.
2. Sudan IV dye will not dissolve in water but dissolves readily in fat.
3. Fat has less density than water--it is lighter.

Using the materials available in your lab area, design one or more assays for fat. Your department head should be prepared to explain your assay methods at the general board meeting immediately following this work period. Assay data sheets should be reviewed with the Chairman of the Board before said board meeting presentation.

Work Assignment for Protein Department

Given Facts:

1. When protein is mixed thoroughly with an equal volume of 10% Sodium Hydroxide (NaOH) solution, and .5% Copper Sulphate ($CuSO_4$) is added drop by drop, a color change will occur.

2. A violet color indicates proteins.

3. Make all dilutions of food approximately 1 gram/20 mls. H_2O.

Using the materials available in your lab area, design one or more assays for protein. Your department head should be prepared to explain your assay methods at the general board meeting immediately following this work period. Assay data sheets should be reviewed with the chairman of the board before said board meeting presentation.

Work Assignment

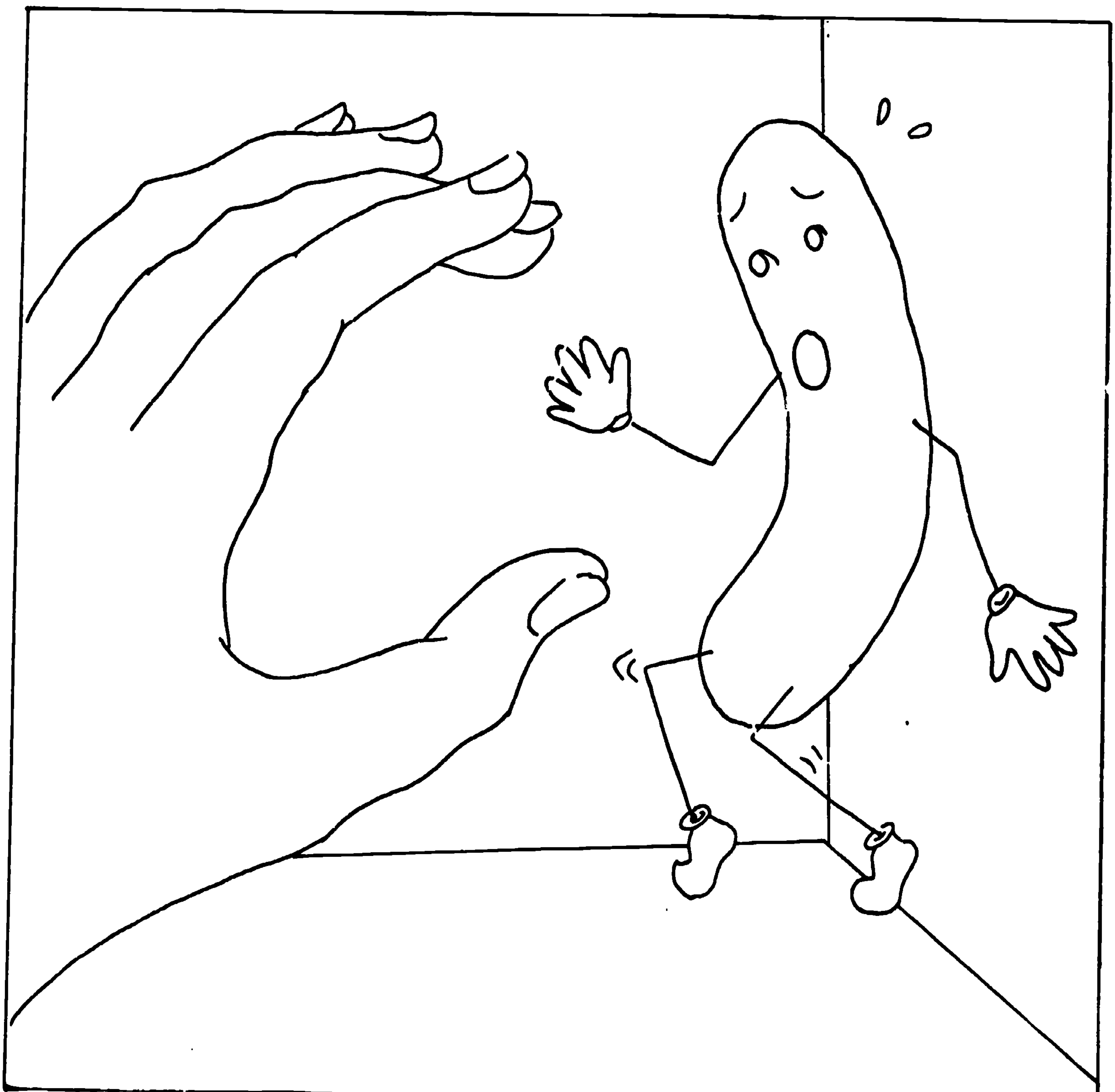
Vitamin Department

Given Fact:

1. Ascorbic acid (Vitamin C) when added drop by drop to indophenol solution, will cause the blue color to disappear.

Using the materials available in your lab area, design one or more assays for vitamins. Your department head should be prepared to explain your assay methods at the general board meeting immediately following this work period. Assay data sheets should be reviewed with the Chairman of the Board before said board meeting presentation.

Dont eat that dog!



THERE'S A NEW YOU COMIN' EVERYDAY. . .
EVERYDAY

And this is no exaggeration! "You", your body, appears to have a solid sameness from day to day. However, the substances which make up the living body are not in a fixed state. Not only our body fluids and active tissues, but all the other tissues that we generally think of as solid, such as bone and nerves, are constantly changing their particles. These particles are generated by the body from the food we eat. Each day we exchange about 5% of our body weight. In other words, a person "turns over" a mass of material amounting to his own body weight every 20 days. In this way every tissue from toenails to hair on our heads, undergoes a complete change of particles periodically.

Picture each different tissue of the body--blood, bone, nerve, organs--as being made up of a certain recipe of ingredients. As each separate recipe is being stirred, more ingredients are being added as the same amount of ingredients already in the recipe are being drawn off. Each different tissue has its own particular rate of exchange. "What you eat today will walk and talk tomorrow!"

It is easy to see that good nutrition calls for all the essential nutrients, or particles, that the body needs, not only in certain amounts, but also in certain proportions.

Our bodies use food in 2 main ways:

1. Fuel source--to keep it running
2. Nutrient source--for repair and maintenance

All foods can serve as fuel--but we need many different foods to get all the nutrients needed. Most foods are a mixture of protein, carbohydrates, and fat (along with varying amounts of vitamins and minerals).

It is important to note that both fat and carbohydrate can be stored in our bodies. Protein, however, which is so essential for body upkeep, is not stored in the body. We MUST have protein daily.

Just as the amount of fuel needed to run an engine can be calculated, so can the amount of energy-producing food necessary for our bodies be calculated.

The energy value of food is measured in units of heat energy, or Calories. In terms of actual food, a Calorie is equal to the food-energy in three drops of honey--1 gram of fat yields nine calories of food energy, 1 gram of protein and 1 gram of carbohydrate both yield four calories of energy.

The amount of energy-providing food a person requires daily depends on his body weight and his muscular activity. He needs about 1 calorie/minute just to stay alive. A moderately active person, for example, whose normal weight is 150 lbs. might require 15 calories for every lb. or a daily intake of 2250 calories. This intake would maintain body weight without weight gain or loss resulting.

To be sure we get all the essential nutrients we need, a diet should be "balanced". A balanced diet contains approximately 12-14% protein, 35% fat, and the rest carbohydrate.

The following activities will allow you to apply the knowledge you have gained concerning assay techniques and body chemistry to actual consumer products on the market today. It is hoped that such activities will develop in you an "awareness" of both nutritional problems as such, and problems facing the consumer in the U.S. due to current marketing practices. These activities might also serve as a guide for self-evaluation of eating habits. Each one of us can profit by analyzing our personal food intake in terms of nutritional value. Frequently, we "remember the Alpo" for Rover, but forget our own bodies need proper care, too!

Work Assignment: All Departments

Apply the assay that you designed last week to as many of the products available as possible. Be prepared, as experts in your area, to help evaluate their nutritional value at the general board meeting following this work period.

CONSUMER PRODUCTS DATA SHEET

++ very concentrated
+ present
- not present

Food	PolySac Starch	MonoSac Sugar	Lipid	Protein	Vitamin C

HOW MUCH DO YOU PAY FOR PROTEIN?*

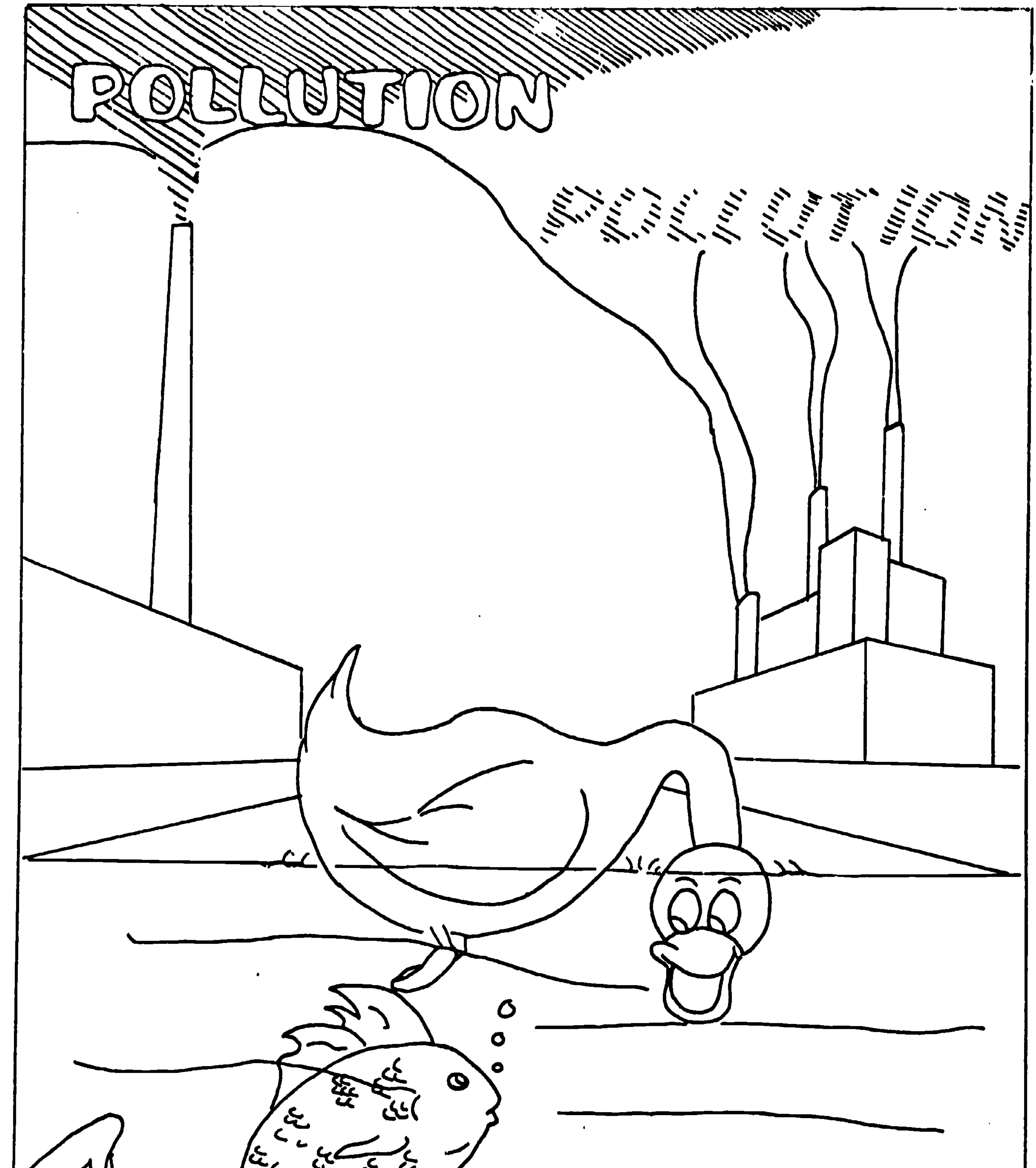
Price/ lb.	Food	% Protein	% Carbo-hydrate	% Fat	Price/lb. of Protein
$ .79	Bacon	12.20	1.4	53.0	$ 6.48
$ .89	Beef liver	19.70	6.0	3.2	$ 4.54
$ .59	Bologna	14.40	0.0	18.0	$ 4.13
$ .94	Cereal-Sp. K	20.00	73.4	1.2	$ 4.70
$1.25	Cheese(natural)	21.83	1.8	25.0	$ 6.90
$ .29	Chicken	21.10	0.0	4.5	$ 1.38
$ .39	Eggs	12.80	.7	11.5	$ 3.02
$1.19	Ham	14.60	.3	44.0	$ 8.15
$ .69	Hamburger regular	27.00	0.0	18.8	$ 2.56
$ .95	lean	29.00	0.0	4.75	$ 3.27
$ .79	Hot dogs	11.00	1.7	30.0	$ 7.19
$3.38	Lobster	16.20	.5	1.9	$20.96
$ .13	Milk	3.50	4.9	3.9	$ 3.70
$1.30	Oysters	9.80	5.9	2.0	$13.26
$ .64	Peanut Butter	26.70	21.3	48.70	$ 2.39
$ .69	Pork Chop	14.80	0.0	32.0	$ 4.69
$ .49	Pork Sausage	10.80	0.0	44.8	$ 4.56
$1.59	Roundsteak	18.70	1.4	17.0	$ 8.43
$1.19	Salmon	17.40	0.0	16.5	$ 6.78
$1.89	Sirloin	15.60	0.0	31.0	$12.10
$1.90	Shrimp	25.40	.2	1.0	$ 7.48
$1.89	T-bone	15.60	0.0	31.0	$12.10
$1.08	Tuna	29.00	0.0	8.3	$ 3.72

*Current prices from a local grocery store

SELF-EVALUATION CHART

Food Intake (Average day)	Protein	Fat	Carbohydrate	Calories
Breakfast				
Lunch				
Dinner				
Snacks and Extras				
Totals				
"Balanced" Day	13%	35%	52%	Your Weight x 15 calories

NNA Labs-- General Board Meeting Notes



I'd trade with you but it wouldn't make any difference.

Money or Pollution---What's the Solution

Until recently, we have always considered population growth and economic growth very desirable. This country has always had a "more is better" philosophy. However, it has become obvious that continued growth in population and material production will lead to the eventual consumption of all the earth's resources. Another result of continued growth is pollution.

It is true that people pollute, but so do industries. It is much cheaper to dump harmful chemicals in the stream than to remove them from the waste outflow. It is easier to let smokestacks belch out harmful fumes than to install effective filtering systems. It is better business for a popular product to have a short duration because people will hurry back and buy more. --- The worn-out item just adds to our solid waste.

Wouldn't product quality and duration be more important than producing a great quantity of things that have a built-in obsolescence?

Shouldn't proper production methods that minimize pollution be more important than cheaper methods that foul our environment?

Shouldn't recycling methods that conserve our precious resources be more important than the increased consumption of our dwindling resources simply because it is cheaper to use the raw materials?

Poor Mother Nature----being tricked into thinking margarine is pure creamery butter isn't her only problem. She has to salvage the environmental mess we've made in the name of technological advancement!

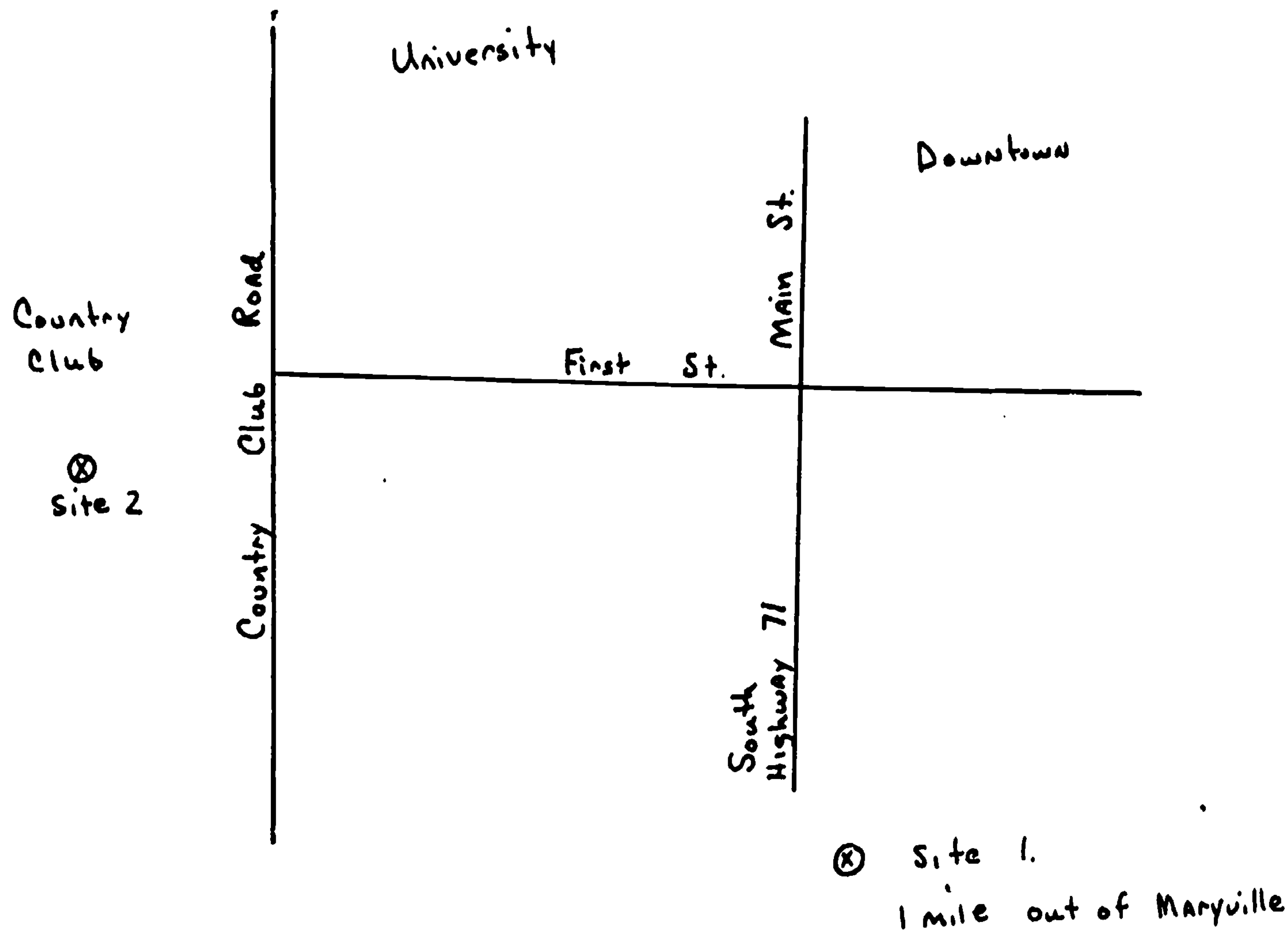
The Harrison Paper Company

A Division of Seeway Industries

Mr. J.P. Hizzel has been president of Harrison Paper Company since 1969. The company headquarters are located in Seattle, Washington. The HPC has six manufacturing plants and a total employment figure around 4,000 people.

The principle products of the Harrison Paper Co. are paper napkins, cups, plates, tissues, and toilet paper.

HPC is planning to build a new plant in Maryville, Missouri. There are two possible construction sites.



Either site will be comprised of 100 acres. The price for the land at site 1 would be about $400 per acre. The land at site 2 would cost about $500 per acre.

The construction costs are estimated at $10,000,000. Since some local labor would be hired during the building stages and some local materials used, Maryville would benefit economically.

The plant would employ 200 people the first year, then it would expand to approximately 450 people the second year. About 100 people would be transferred to Maryville and the rest would be hired from the Maryville community.

The Harrison Paper Company would have a yearly payroll of over $2,700,000. Most of this money would remain in the Maryville economy.

In Maryville there are no definite waste disposal standards. Proper filter systems for such a large plant are quite expensive to install and maintain. Maryville has no organized labor unions. All other HPC plants employ members of the United Papermakers and Paperworkers Union.

Several groups interested in promoting or in protesting the construction of the Harrison Paper Co. will be present at the Town Meeting next week. Among the groups planning to attend are:

1. <u>The Environmental Control Board</u>

   This organization scrutinizes industries and public service companies to insure their compliance with state and federal environmental legislation. In addition, they often submit new regulations for legislative consideration.

2. Representatives of the Harrison Paper Company

3. Representatives of City Hall

4. The Power and Light Company

5. The Industrial Development Corporation

   An organization which attempts to attract new industries to this area.

6. Representatives of the University

7. The RASCALS Etc.

   (Radical American Student Caucus Against Lethal Smoke Etc.) This is a student group dedicated to strict environmental legislation.

8. The Citizens League

   A private group that is interested in the direction of Maryville's development and growth.

The present level of air and water pollution can be measured if you are interested. The necessary materials are available upon request.